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NECESSITY OF POLLINATION BY MELLIFEROUS BEES AT SUNFLOWER HYBRIDS ACTUALLY CULTIVATED IN ROMANIA

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Abstract

Within this paper there are presented the results of the researches carried out in the period 2002-2008 at an assortment of 34 sunflower hybrids with respect to the visit frequency of the pollination insects on the sunflower heads, the percentage of self-fertility and the gain in seed yield through pollination, compared to the yield obtained under self-fertility conditions. The experiments were carried out within the experimental farm belonging to the University of Agronomic Sciences and Veterinary Medicine of Bucharest, located on a reddish preluvosoil at Moara Domnească (15 km faraway from Bucharest on North-East direction). The results of researches show that the sunflower growers have to pay attention of bringing the beehives for pollinating the sunflower crops, in view to get a gain in seed yield up to 1390 kg per hectare, according to the hybrid. The melliferous bees are necessary especially for the hybrids with the highest gain in seed yield and small self-fertility percentage, but also for the other hybrids in view to be sure the pollination is assured under any climatic conditions.

INTRODUCTION

Sunflower seed yield is depending very much of pollination made by the melliferous bees and other spontaneous insects. The melliferous bees have the most important role in assuring pollination of the sunflower crops [1]. The sunflower grower has to know for each sunflower hybrid which is the percentage of self-fertility [2] and the gain in seed yield obtained through pollination carried out by insects. Thus, he will become aware of the importance of pollination of the sunflower crops, according to the cultivated hybrid, and will become concerned to assure the necessary beehives with melliferous bees for assuring the proper pollination of the sunflower crops.

MATERIAL AND METHODS

In the period 2002-2008, researches were carried out in field experiments for studying an assortment of 34 sunflower hybrids, among which 13 were Romanian hybrids (Favorit, Florom 350, Turbo, Performer, Splendor, Felix, Justin, Trajano, Select, Alex, Hercule, Festiv and Romina) and 21 were foreign hybrids (Huracan,

Kasol, Lindor, Masai, Mateol, Podium, Saxo, Sunko, Fly, Rigasol, Rigasol OR, Fleuret OR, Arena, Melody, NK Armoni, Alexandra, NK Dolbi, NK Ferti, Opera PR, Sanay and Rocky). The 13 Romanian sunflower hybrids were studied in the years 2002, 2003, 2004 and 2005, among which 2002 was a drought year and 2004 was a favourable year for sunflower crops. The 21 foreign sunflower hybrids were studied in the years 2006, 2007 and 2008, among which 2007 was a very drought year and 2008 was a favourable year for sunflower crops.

The experiments were located on a reddish preluvosoil at 15 km faraway Northeastern from Bucharest, within the experimental farm Moara Domnească belonging to the University of Agronomic Sciences and Veterinary Medicine of Bucharest.

In view to establish the frequency visit of the pollination insects on the sunflower heads, observations and determinations were made at the 13 Romanian sunflower hybrids. The frequency visit of the pollination insects was determined by numbering the melliferous bees and other pollination insects that visited 4 neighbour sunflower heads in a time of 5 minutes. Also, for each pollination insects, it was determined the time of visits on the sunflower head. The observations and determinations were carried out in diferent 4 locations of each experimental plot.

In view to establish the number of seeds per sunflower head isolated from pollination insects and the number of seeds per sunflower head free-pollinated, determinations were performed for 10 Romanian sunflower hybrids and 21 foreign sunflower hybrids. This was made in view to calculate the degree of self-fertility and to establish the necessity of pollination. Also, there were performed yield determinations in view to calculate the seed yield obtained under pollination conditions and the gain in seed yield through pollination (compared to the yield obtained under self-fertility conditions).

In view to determine the self-fertility degree, five plants from each experimental plot (29.4 m^2 resulted from six plant rows at 0.7 m between rows and 7 m along the rows) were mull isolated ant their heads were analyzed at the maturity stage, parallel with another five heads free-pollinated. The percentage of self-fertility was estimated according to the following formula [3]:

$$\text{Self - fertility} = \frac{\text{average no of fertile achenes per isolated sunflower head}}{\text{average no of fertile achenes per freely pollinated sunflower head}} x100 \quad (\%)$$

RESULTS AND DISCUSSION

The insects that were found on the sunflower heads and that have a role in the pollination process are the following: melliferous bees, lepidopterous (butterflies), dipterous (flies), hymenopterous (wasps, wild bees), heteropterous (bugs).

The melliferous bees represent the most important insects in pollination sunflower crops because they have the most important visit frequency on the sunflower heads. Thus, the average visit frequency on sunflower heads was of 82% for melliferous bees and 18% for the other insects from spontaneous fauna (figure 1).

The visit frequency on sunflower heads is different according to sunflower hybrid, which means that each sunflower hybrid has a different attractiveness for the pollination insects. The visit frequency on sunflower heads for the melliferous bees varied between 70% (e.g. Justin hybrid) and 100% (e.g. Florom 350 and Felix hybrids).

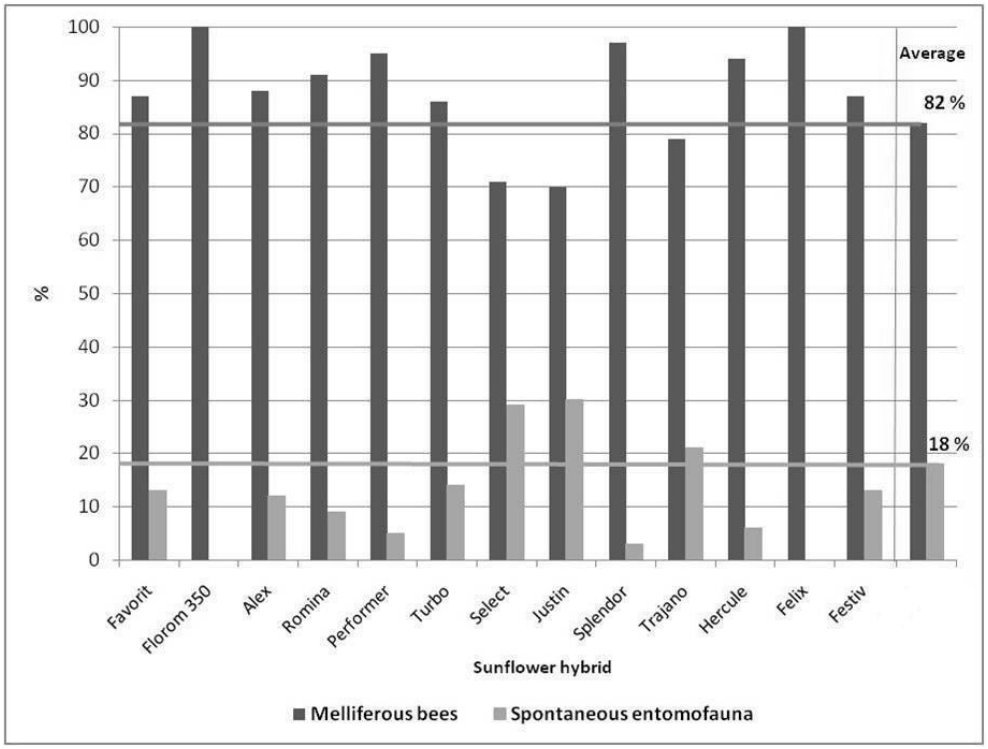

Fig. 1. Variation of the frequency visits of the pollination insects at different sunflower hybrids

Among the pollination insects from spontaneous fauna, the bumble bees are the most important pollinating insects for sunflower crops, with an average visit frequency on sunflower heads of 3%. Also, an important role for pollinating the sunflower crops is playing by the different species of butterflies, with an average visit frequency on sunflower heads of 3.4%.

During the period of determinations in the field, there were not observed any cases of abjections or competition among the insects visiting the sunflower heads. Very seldom, the buzz of a bumble bee has determined the melliferous bees to fly away on other sunflower head.

The percentage of self-fertility at the studied sunflower hybrids ranged from 18% (Romina and Select hybrids) to 98% (Performer and NK Armoni hybrids). The hybrids with the highest self-fertility percent under time (more than 70%, in all the studied years) were the following: NK Armoni, Melodi, Huracan, Sanay, Opera, NK Ferti, Rigasol OR, Masai and Saxo. The hybrids with the smallest self-fertility percent under time (less than 70%, in all the studied years) were the following: Romina, Festiv, Favorit, Splendor, Kasol, Fleuret OR and Rocky (table 1).

There are some sunflower hybrids with a relatively stable self-fertility percentage under time (e.g. NK Armoni, Melody, Huracan and Rigasol OR), while for the majority of the sunflower hybrids there are some significant differences during the time, and even for a few sunflower hybrids there are large differences from one year to another one, as for example for Select, Alex and Justin sunflower hybrids. The variation in time of the percentage of self-fertility is registered because this is affected by the climatic conditions.

If there is taken into consideration the average share of the spontaneous entomofauna and the gain in seed yield through pollination, then we can conclude that the presence of melliferous bees is not strictly necessarily for pollinating some sunflower hybrids (e.g. NK Armoni hybrid). There are some sunflower hybrids that do not need the presence of melliferous bees for pollinating in some years (e.g. Melodi, Huracan, Sanay, Opera PR hybrids). However, for the majority of the sunflower hybrids, the melliferous bees must be present in order to perform pollination and to insure increased seed production, and for some of them even been obligatory (e.g. Romina, Festive, Lindor, Fly and Arena hybrids).

The gain in seed yield through pollination, compared to the yield obtained under self-fertility conditions ranged from 10 to 1390 kg per hectare, according to the hybrid and climatic conditions of the year. Thus, sunflower growers must take into account the necessity of bringing the necessary beehives for pollinating the sunflower crops, especially for the hybrids with the highest gain in seed yield (Fly, Lindor, Kasol, Arena, Mateol, Romina, Festiv, Saxo hybrids), but also for the other sunflower hybrids in view to be sure that the pollination is assured and do not depend on the climatic conditions.

Seed yield obtained under pollination and currently technological conditions in South Romania for the studied sunflower hybrids varied from 760 to 4310 kg per hectare. The smallest yields were registered in the drought years 2002 and 2007, which were less favourable for the sunflower crops.

Table 1

Data regarding the limits of variation for the self-fertility and seed yields for an assortment of sunflower hybrids grown in Romania

Nr. crt.	Sunflower hybrid	Self-fertility (%)	Self-fertility plus the average share (18%) of the spontaneous entomofauna (%)	Gain in seed yield through pollination (compared to the yield obtained under self-fertility conditions) (q/ha)	Seed yield obtained under pollination and currently technological conditions (q/ha)
1.	Favorit	20 – 60	38 – 78	1.8*	17.9*
2.	Performer	61 – 98	79 – 100	1.1*	21.7*
3.	Splendor	47 – 69	65 – 87	1.7*	18.7*
4.	Felix	48 – 81	66 – 99	1.0*	20.8*
5.	Justin	46 – 97	64 – 100	6.3*	18.1*
6.	Select	18 – 93	36 – 100	6.0*	24.0*
7.	Alex	36 – 91	54 – 100	2.2*	16.8*
8.	Hercule	29 – 75	47 – 93	1.0*	17.7*
9.	Festiv	33 – 54	51 – 72	8.8*	20.5*
10.	Romina	18 – 47	36 – 65	9.1*	20.3*
11.	Huracan	88 – 94	100	2.6 – 5.3	19.4 – 30.3
12.	Kasol	50 – 64	68 – 82	1.5 – 12.9	7.6 – 36.6
13.	Lindor	52 – 73	70 – 91	4.0 – 13.6	9.6 – 40.9
14.	Masai	72 – 84	90 – 100	1.5 – 8.3	8.3 – 36.2
15.	Mateol	57 – 79	75 – 97	0.7 – 10.6	13.8 – 39.7
16.	Podium	66 – 91	84 – 100	0.1 – 5.4	9.7 – 40.6
17.	Saxo	70 – 83	88 – 100	2.9 – 9.5	10.3 – 43.1
18.	Sunko	56 – 85	74 – 100	1.1 – 6.0	9.8 – 29.3
19.	Fly	58 – 84	76 – 100	3.3 – 13.9	10.8 – 41.4
20.	Rigasol	61 – 80	79 – 98	0.6 – 7.3	12.9 – 30.7
21.	Rigasol OR	78 – 83	96 – 100	0.4 - 3.6	10.7 – 14.0
22.	Fleuret OR	51 – 62	69 – 80	3.7 – 6.7	10.6 - 34.0
23.	Arena	59 – 73	77 – 91	3.0 – 10.4	8.9 – 35.2
24.	Melody	87 – 90	100	1.9 – 6.8	10.6 – 35.8
25.	NK Armoni	93 – 98	100	0.6 – 1.3	8.5 – 29.2
26.	Alexandra	61 – 93	79 – 100	2.5 – 4.7	9.7 – 30.2
27.	NK Dolbi	55 – 86	73 – 100	5.5 – 7.5	12.7 – 32.9
28.	NK Ferti	70 – 81	88 – 99	2.7 – 6.2	19.9 – 34.7
29.	Opera PR	74 – 86	92 – 100	1.1 – 6.5	7.6 – 32.2
30.	Sanay	75 – 89	93 – 100	1.8 – 6.8	11.8 – 36.7
31.	Rocky	55 – 66	73 – 84	4.7 – 8.7	11.6 – 34.8
Limits of variation		18 – 98	36 – 100	0.1 – 13.9	7.6 – 43.1

** Average values for the studied years*

CONCLUSIONS

1. Melliferous bees represent the most important insects for pollinating sunflower crops, these having an average visit frequency of 82% from the total insects visiting the sunflower heads.
2. Among the pollination insects from spontaneous fauna, the bumble bees (3%) and different species of butterflies (3.5%) are the most important.
3. Percentage of self-fertility at the studied sunflower hybrids ranged from 18% (Romina and Select hybrids) to 98% (Performer and NK Armoni hybrids).
4. Among the studied sunflower hybrids, the highest self-fertility percentage under time (more than 70%) were obtained at NK Armoni, Melodi, Huracan, Sanay, Opera, NK Ferti, Rigasol OR, Masai and Saxo hybrids.
5. Among the studied sunflower hybrids, the smallest self-fertility percentage under time (less than 70%) were obtained at Romina, Festiv, Favorit, Splendor, Kasol, Fleuret OR and Rocky hybrids.
6. There are some sunflower hybrids with a relatively stable self-fertility percentage under time (e.g. NK Armoni, Melody, Huracan and Rigasol OR), while the majority of the sunflower hybrids registered significant differences during time, due to the influence of the climatic conditions.
7. For the majority of the sunflower hybrids, the melliferous bees must be present in order to perform pollination and to ensure increased seed yield.
8. The gain in seed yield obtained through pollination, compared to the yield obtained under self-fertility conditions, ranged from 10 to 1390 kg per hectare, according to the hybrid.
9. Sunflower growers have to pay attention of bringing the beehives for pollinating the sunflower crop, especially for the hybrids with the highest gain in seed yield, but also for the other sunflower hybrids in view to be sure the pollination is assured under any climatic conditions.

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